

CLAIMS

What is claimed is:

1. A method for automated focusing of an electron image, the method comprising:

determining an energy filter cut-off voltage; and
adjusting a focusing condition in compensation for a change in the energy-
5 filter cut-off voltage.

2. The method of claim 1, further comprising:
varying an energy filter voltage to different levels;
measuring an intensity of detected electrons at each of the different levels;

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analyzing the intensity data so as to determine the energy filter cut-off
voltage.

3. The method of claim 1, wherein the focusing condition comprises a
15 wafer bias voltage, and wherein the wafer bias voltage is varied in correspondence
to the change in the energy filter cut-off voltage.

4. The method of claim 1, wherein the focusing condition comprises an
objective lens focusing strength.

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5. The method of claim 1, wherein the focusing condition comprises an
extraction field strength.

6. The method of claim 1, wherein the focusing condition comprises a
25 source voltage level.

7. The method of claim 1, further comprising using a contrast-based focusing procedure for fine focusing of the electron image.

5 8. An apparatus for automated focusing of an electron image, the apparatus comprising:

- an electron detector configured to receive and detect scattered electrons;
- an energy filter configured to filter the scattered electrons prior to the electron detector;
- 10 a filter bias voltage device coupled to the energy filter to apply a controllable filter bias voltage thereto;
- a focusing device for adjusting a focus of the electron image; and
- a controller coupled to the electron detector, the filter bias voltage device, and the focusing device,
- 15 wherein the controller varies the filter bias voltage to determine a change in energy filter cut-off voltage and adjusts the focus of the electron image in compensation for the change.

20 9. The apparatus of claim 8, wherein the energy filter comprises a grid filter.

10. The apparatus of claim 8, wherein focusing device comprises a wafer bias voltage device coupled to a stage to apply a controllable wafer bias voltage thereto.

25 11. A electron beam inspection apparatus, the apparatus including an autofocusing means that comprises:

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means for determining an energy filter cut-off voltage; and

means for adjusting a focusing condition in compensation for a change in the energy-filter cut-off voltage.

5 12. A method for automated focusing of an electron image in a scanning electron imaging apparatus, the method comprising varying a focusing condition of a primary electron beam in a first image plane so as to maximize an intensity of a secondary electron beam through an aperture in a second image plane.

10 13. The method of claim 12, further comprising:
 turning off scanning of the primary beam; and
 setting a deflector for the secondary beam to a focusing mode upon initiation of the automated focusing.

15 14. The method of claim 13, further comprising:
 turning on scanning of the primary beam; and
 resetting the deflector to an imaging mode upon completion of the automated focusing.

20 15. The method of claim 14, wherein in the imaging mode the secondary beam is deflected so as to circumvent the aperture but still be detected.

 16. The method of claim 12, wherein the focusing condition comprises a wafer bias voltage.

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 17. The method of claim 12, wherein the focusing condition comprises an objective lens focusing strength.

18. The method of claim 12, wherein the focusing condition comprises an extraction field strength.

5 19. The method of claim 12, wherein the focusing condition comprises a source voltage level.

20. A scanning electron beam apparatus for inspection of substrates, the apparatus comprising:

10 an objective lens configured to focus a primary electron beam onto a first focal point in a first plane at a substrate, where the primary electron beam causes emission of secondary electrons;

an electron detector configured to receive and detect the secondary electrons;

15 a second lens configured to focus a beam of the secondary electrons onto a second focal point in a second plane when the primary electron beam is in-focus; and

an aperture centered around the second focal point when the primary electron beam is in-focus.

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21. The apparatus of claim 20, further comprising:

a beam deflector configured to provide a focusing mode and an imaging mode.

25 22. The apparatus of claim 21, wherein, in the imaging mode, scanning is turned on and the secondary beam is deflected so as to circumvent the aperture but still be detected.

23. A scanning electron imaging apparatus with an automated focusing capability, the apparatus comprising:

means for varying a focusing condition of a primary electron beam in a first
5 image plane so as to maximize an intensity of a secondary electron beam through
an aperture in a second image plane.